

EFFECT OF WETLAND ON CASSAVA PRODUCTION IN ORHIOMWON LOCAL
GOVERNMENT AREA OF EDO STATE, NIGERIA

BY

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PROJECT SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL ECONOMICS
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CERTIFICATION

This is to certify that the research work on the Effect of wetland on Cassava Production in Orhionwon Local Government Area of Edo State was carried out by OKOH LUKA PAULA with the Mat. No AGR2004286 under the supervision of the department of Agricultural Economics and Extension Services, Faculty of Agriculture, University of Benin, Edo State, Nigeria.

Date: _____

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Date: _____

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DEDICATION

I wholeheartedly dedicate this research work to God Almighty, the source of wisdom, strength, and inspiration. His grace has guided me through every step of this journey. To Him be all the glory.

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ABSTRACT

This study investigated the effect of wetland conditions on cassava production in Orhionmwon Local Government Area of Edo State, Nigeria. The objectives were to examine the socio-economic characteristics of cassava farmers, compare the costs and returns between wetland and arable land farmers, assess technical efficiency, evaluate yield differences, and identify coping strategies used to manage environmental challenges.

Primary data were collected from 96 cassava farmers selected through a multistage sampling procedure across four wetland and four arable land communities. A structured questionnaire was administered, and the data were analyzed using descriptive statistics, gross margin analysis, stochastic frontier production function, and t-tests to compare profitability, yield, and efficiency across both farming environments.

The results showed that cassava production was profitable in both environments but significantly more profitable in arable land areas. Arable land farmers earned higher average profit (₦490,438.60) than wetland farmers (₦150,583.63), and also recorded higher mean yields (2,279 kg compared to 1,413.4 kg). Technical efficiency was similar for both groups, with mean scores of 0.629 (wetland) and 0.632 (arable land). The study further revealed that wetland farmers face challenges such as flooding, high weed pressure, and higher production costs, prompting coping strategies like off-farm income, livestock rearing, and cooperative membership.

CHAPTER ONE

INTRODUCTION

1.1 Background study

Cassava (*Manihot esculenta*) is a perennial Woody shrub with an edible root which grows in tropical and subtropical areas of the world. It originates from central and south America and was first introduced into Africa in the Congo basin by Portuguese traders in 1558 and it currently supports more than 300 million Africans (IITA, 2020). Cassava (*Manihot esculenta*) plays a pivotal role in Nigeria's agriculture and economy. As the world's largest producer of cassava, Nigeria's cultivation of this versatile crop has grown significantly over the years. In the years proceeding, Nigeria's cassava production has experienced significant growth, establishing itself as a key player in the nation's agricultural landscape. In 1972, Nigeria's cassava production stood at 9.57 million tons. This increased to 33 million tons in 1999, 45 million tons in 2009. In 2019, it contributed 3.54 million metric tons to the national cassava production; according to the National Bureau of Statistics (NBS, 2022). Nigeria accounts for at least 21% of global cassava production. The country exports cassava to various nations, including the United Kingdom, Ghana, Spain, Canada, and the United States of America. In 2021, Nigeria exported cassava worth \$1.02 million. Cassava has always been important to Nigeria's economy, it is the most abundant staple food in Nigeria after rice .Notably cassava contributes to about 45% of Nigeria's agricultural GDP; this reflects its pivotal role in sustaining the nation's rural economy (Abasifon, 2023).

The total wetland area in Africa amounts to about 5.6 million km²(i.e. about 16% of the total area of the continent). The major wetland soils, however, represent a total area of 3.4million km²(i.e. 9-10% of the continent). The wetland soils of Africa consist of: histosols (205,333

km²), gleysols (1,783,948 km²), fluvisols (1,376,534 km²) and temporarily, flooded soils (2,280,847 km²). In Nigeria we have four types of wetland namely; marshes, swamps, bogs and fens. The wetland ecosystem plays a critical role in supporting the livelihood of millions of people. The total area of Nigeria's 11 wetland is about 1,076,728 hectares and they include ; Lake-chad wetland in Borno state, Dagona birds sanctuary in Yobe state, Apoi creek forest in Bayelsa state and others (Olalekan et al, 2014). Wetlands are mainly located in the South - South region of Nigeria ; in places like Edo state, Delta state, Rivers State, Bayelsa, Akwa ibom and so on . In general we have 18 LGA Government in Edo State namely; Akoko-Edo, Egor, Esan Central, Esan North-East, Esan South-East, Esan West, Etsako Central, Etsako East, Etsako West, Igueben, Ikpoba-Okha, Oredo, Orhionmwon, Ovia North-East, Ovia South-West, Owan East, Owan West and Uhumwonde. There are LGA in Edo state that possess wetland soils, places like Ikpoba-okha , Orihomwon , Okomu and so on .

1.2 Statement of problem

The major agricultural problems associated with wetland soils are: Abundance of water, weeds, diseases and pest control and poor yielding crop varieties (Paul et al, 2020). From general knowledge cassava is known to do well in tropical regions i.e cassava produce minimally in waterlogged conditions compared to its yield in upland condition. Excessive rainfall and poor drainage ability can lead to root rot of tubers and reduced productivity. If the water level is not managed properly, it will subsequently result in flooding and soil erosion that wipes out soil nutrient thereby reducing the available nutrient for plant growth. Another very important challenge faced in the wetland region is abundance of weed; due to the fact that water is always present in the wetland soil it gives room for weeds to grow. As we all know that weed competes with the crop (cassava) for nutrients and space, the

availability of excess weed will reduce drastically the yield of production because the nutrients needed for the cassava are being consumed by the weed for growth. Weeds that thrive in wetland are very aggressive such as *Ageratum conyzoides*, *Chromolaena odorata*, *Dignitaries horizontals* etc. It can be controlled by reducing the high water level or by mulching but mulching is not advisable in this condition because the other function of mulching is to conserve soil moisture level (which is very high). Changes in climate can influence the prevalence and distribution of pests and diseases affecting cassava where the pest feed on the tuber or any other part of the plant that causes malfunction in the organs of the plant and this gradually leads to diseases that makes the unfit for consumption (Havalend et al, 2019)

Regardless the fact that cassava thrives well on arable land it also has problems associated with the dry season most especially when it experiences extreme temperature it leads to drought (loss of water) reduced soil moisture which leads to the reduced size in tuber crop, moisture stress on the plant, wilting of the leaves and dying which leads to reduction in yield at the end of the planting season if not remedied. There are some mitigation processes to take in order to prevent the effect which are; Use of drought resistant variety, Irrigation process, Use of sunken bed method etc(Ayeb-Karlsson et al ,2016)

This study is required to provide answers to the following questions:

What are the socio- economic characteristics of cassava farmers in the wet land and arable land area

What are the costs and returns; and the profitability of farmers that cultivate in the wetland and arable land area

What are the technical efficiency between farmers that cultivate in the wetland and arable land area

What are the yield of farmers in wetland and arable land area and;

What are the coping strategies farmers employed to remedy the effect on wetland and arable land area

1.3 Objective of the study

To achieve the main objective, the specific objective are to

describe the socio- economic characteristics of cassava farmers in the study area

estimate and compare cost and returns and the profitability of cassava production between farmers in wetland and arable land area

estimate and compare technical efficiency between farmers in wetland and arable land in the study area

estimate and compare the yield of farmers in both wetland and arable land area and;

identify the coping strategies farmers employed to remedy the effect on the wetland and arable land area.

1.4 Justification of study :

Not much work has been done in this area of research according to the researcher's knowledge ; Therefore this current study is justified as it focuses on comparing the socio-economic characteristics, cost and returns, and technical efficiency of farmers in wetland and arable land area of Orhionmwon Local Government Area. In the previous study carried out by Paul et al (2020), which talks about the Effect of wetlands on cassava and vegetable production with Kogi state as the case of study the researcher focused on informations about the farming season, also described farmer's occupation, examined the social and

infrastructures, described the socio-economic factors, examined the spatial distribution and pattern of socio-economic development. With all these findings there is still a significant gap in this study which this current study aims to reduce by comparing the cost and returns of farmers in wetland and arable land area ; and also estimating the technical efficiency of farmers in both areas which would be useful to the cassava farmers, other research institutions and Government in the formulation of policies that would be helpful to farmers and will also provide valuable insights into the benefits and challenges of farming in these areas. By identifying effective coping strategies for farmers in wetland regions, this study will contribute to improving cassava production, enhancing food security, and supporting the livelihoods of farmers.

CHAPTER TWO

Literature review

2.1 Cassava production

Cassava is a perennial woody shrub that has edible roots which is one of the most staple foods in Nigeria; it originated in Central and South America and was introduced into Nigeria in the sixteenth century (Adeniji et.al.,2005). Cassava is well-known for its year-round availability, climate resilience, and ability to thrive in poor soils (Asante-Pok, 2013). In Nigeria, it is a staple food for over 70% of the population and serves as a critical income source for agrarian households (Eke-Okoro and Njuko, 2012; Sanusi et al.,2020). Nigeria remains the world's largest producer of cassava, with an output of 368 million metric tons annually (Brodrick and Sanzudur, 2016). Despite Nigeria's status as the leading global producer of cassava, the productivity levels in many cassava producing areas, including Edo State, remain significantly below potential (Oyotomhe et.al., 2025). Smallholder farmers, who constitute the bulk of producers, face numerous challenges such as inadequate access to improved inputs, limited extension support, poor market infrastructure, and inefficient production practices.

According to FAO (2018), as of 2018, world cassava production stood at about 278 million tonnes; Africa total production was about 170 million tonnes (about 56% of world production). At the same period, Nigeria produced about 60 million tonnes (FAOSTAT, 2019). However, during this period, cassava production in Nigeria has soared by about 49

million tonnes. Behind Nigeria's total cassava production of 60 million tonnes are Thailand (31 million tonnes), Indonesia (19 million tonnes) and Ghana (18 million tonnes). Major cassava producing states in Nigeria are Benue, Kogi, Cross River, Ondo, Imo, Akwa Ibom, and Rivers states (Daniels et al., 2011). Experts have argued that cassava production is one of the well-developed agricultural crops in Nigeria because of its relatively well established processing techniques. Cassava can be processed into varieties of products – e.g food and starch for industrial use. These products include:

cassava flakes (gari),

cassava flour (pupuru and lafun),

cassava paste (fufu) which are derived from cassava roots.

2.2 Wetland

Wetland occurs where water meets land and ensures sustainability of both ; its unique habitat include mangrove, peat-land, rivers, lakes, deltas, meadows and coral reef. Wetland covers a small percentage of the earth surface yet they are rich in nature and vital to human life.

Despite the fact that they are rich in nature, excessive waterlogging causes loss in the yielding of the crop. We have lost 35% of the world to wetland since 1970 and we continue to lose them at a faster rate than we are losing forest (Wetland International). In Nigeria we have four types of wetland namely; marshes, swamps, bogs and fens. The wetland ecosystem plays a critical role in supporting the livelihood of millions of people (Environews, 2023). The total area of Nigeria`s 11 wetland is about 1,076,728 hectares and they include ; Lake-chad wetland in Borno state, Dagona birds sanctuary in Yobe state, Apoi creek forest in Bayelsa state and others (Environews , 2023). The wetlands, are seasonally or perennially wet and have ample water supply occur in level to gently sloping landscapes,are large that large-scale

farming is feasible, evapotranspiration (ET) and drainage, a favourable soil water balance develops, the varying in depth from a few centimeter to several meter deep, suggesting the determinant of the potential land use; The result is that much of the wetlands are groundwater table. When water inputs from rainfall and overland flow exceeds and are immune to the hazards of soil erosion. The soils are saturated 6 to 8 months excess rain water recharges the groundwater, causing a rise in the cyclical period, the water table is at or near the soil surface and flooding may occur prevalence of an aqua-soil moisture regime, and a soil profile that is both characterize the land-type during the rainy season, and naturally the main under fallow because of waterlogging and flooding (Aghanenu & Onemolease ,2015).

The lowlands are important in agricultural development, but much less information is available on them than on the upland ecosystems, which is a considerable impediment for their utilization and intensification on a sustainable basis (Paul et.al., 2020). Obasi, (2018) described multiple roles of wetlands, with a focus on flood plains in dry areas, which sustain populations of human beings and wild species. Until recently, wetland farming has been less attractive because of the arduous task of land preparation, water management, weed control, and the limited repertoire of crops that can be grown (Ehinmowo OO, Adewale IF, Ojo SO. 2017). Wetland ecosystems play a critical role in agricultural productivity, particularly in regions facing variable rainfall and drought stress (Ezui, 2017; Hirooka et al., 2021). In some areas, cassava cultivation has expanded into wetlands, especially where water tables have lowered, making previously flooded areas accessible (Rasmussen et al., 2012). The presence of wetlands can provide consistent water resources, which is a fundamental requirement for cassava production, especially in tropical Nigeria where soil and water resources are key limiting factors (Oshunsanya & Nwosu, 2018).

However, the utilization of wetlands for agriculture, including cassava, requires careful management. Indiscriminate use of agricultural wetlands should be avoided, and their production potential needs to be balanced against potential negative impacts on ecosystem functions (Grotelüschen et al., 2021). For Nigeria specifically, improved utilization and productivity of wetlands necessitate strong public policies, appropriate investment, human capacity building, science-policy-society cooperation, and supportive infrastructure (Akpabio & Umoh, 2021). Studies on cassava yield gaps in Nigeria highlight the importance of understanding limiting factors such as climate and nutrients, which are intrinsically linked to wetland conditions (Srivastava et al., 2023). Furthermore, the adaptation to climate change and its impact on cassava farmers' net revenue in Southwest Nigeria underscores the need for stable and productive environments, which well-managed wetlands can provide (Olutumise et al., 2024)

2.3 VARIETIES OF CASSAVA

Cassava has different varieties and these varieties include those cultivated in arable land and those cultivated in Wetland. Here are some varieties: TME B693, TMS-IBA0007, NR130124, TMS 13F1343P002, TMS 13F1160P000, TMS I 07/0539, TMS I 07/0593, NR 07/0220, TMS I 011206, TMS I 982132, CR 36-5, NR 03/0155, NR 03/0211, TMS 1011371, TMS 1011412, TMS 1011368, TMS 00/0203, TMS 01/0040, CR 41-10, NR 01/0004 and so many more (Nigerian seed portal initiative 2020). From previous studies by (Akparobi et al., 2007) some varieties were cultivated for experiments in dryland(ilorin) and Wetland(Uyo) and from the study all the varieties did well in the arable land but only a few survived in Wetland

because due to water logging the root nozzle could not take up oxygen for respiration which will eventually lead to low yield.

2.4 BENEFITS OF WETLAND

As we all know that Wetland are associated with lots of benefits which are:

Provide habitat for fishes and wildlife

Serve as breeding and feeding site for several avian species

Improved water quality

Flood control

Recreational activities

Used in the cultivation of some crops(rice)

According to FAO;(1998), Coastal areas(wetland) are extremely important for the social and economic welfare of current and future generations. The economies of most developing countries are dependent on natural resources for agricultural activities like fisheries and forestry subsectors; the marine, estuary and coastal wetland areas often benefit from the flow of nutrients from the land and also from ocean upwelling which brings nutrient-rich water to the surface.

Several crops can cultivated in the domestic wetland; crops like rice, vegetables, cranberries from bogs

Despite the fact that some crops can grow there, other crops like cassava cannot withstand the excessive water which leads to tuber rot but some are water-tolerant varieties.

YIELDS OF CASSAVA IN WETLAND

Results gotten from previous studies have shown that cassava has more yield in dryland than wetland. According to (Paul et. al. 2021) there are so many factors that bring about reduction in yield in the wetland areas and they include; Climatic factors, hydrological factors, soil factors, biological factors and socio-economic factors. The major constraints associated with the wetland region are abundance of water and its management, high incidence of weed, pest & disease. It was concluded by Paul et.al. that so far the problems associated with the area are adequately managed, Stakeholders should continuously supply farmers with inputs to reduce the level of food insecurity. Also, the study carried out by Akparobi et. al., 2007 concluded that the yield of some varieties of cassava produced more yield in the dryland (Uyo) than the wetland (Ilorin).

2.5 Analytical Framework

The analytical framework involves the methodologies and tools used to quantify and assess the impact of wetlands on cassava production. This includes a range of approaches from field experimentation to advanced modeling techniques. Analytical frameworks are crucial for evaluating wetland management options, especially in data-poor contexts, and for bridging the gap between scientific understanding and policy formulation (Cools et al., 2013; Johnston et al., 2013).

Determine the Socio-Economic Analysis of cassava farmers

This objective aims to characterize the socio-economic profile of farmers engaged in wetland cassava cultivation and to understand the social context within which their agricultural activities take place. Recent research emphasizes the importance of understanding farmer livelihoods and dependence on wetlands. Structured questionnaires would be administered to

cassava farmers in wetland areas to collect comprehensive data on demographics (e.g., age, education level, household size, farming experience), farm characteristics (e.g., farm size, land tenure), access to resources (e.g., credit facilities, extension services), market access, primary income sources, and their perceptions regarding wetland use and management Oyekola, 2021. Studies like Olarewaju et al. have successfully used surveys to examine livelihood activities and wetland dependence among households in Nigeria Olarewaju et al., 2022.

Cost and Return analysis

This analysis will focus on evaluating the economic viability and profitability of cassava cultivation within wetland ecosystems and the arable land region in the study area. Recent studies have investigated the profitability and economic aspects of cassava production in Nigeria. This involves meticulously collecting detailed data on all costs associated with cassava production (e.g., land preparation, planting materials, labor, fertilizers, pesticides, harvesting, transportation) and all revenues generated from sales. This enables the calculation of gross margins, net returns per unit area, and per farmer. Studies analyzing the profitability of cassava production in Nigeria, such as Bello et al. Bello et al., 2024 and Babatunde et al. BABATUNDE et al., 2022, provide precedents for this methodology. Rozi et al. illustrate production input and labor costs, as well as revenue calculation for cassava farming Rozi et al., 2023. A broader economic assessment can weigh the total costs against the total benefits of wetland-based cassava farming, potentially incorporating external costs and benefits where feasible. Olutumise et al. investigate the opportunity costs of climate adaptations and their influence on the net revenue of cassava farmers, which is highly relevant for a cost-benefit

analysis Olutumise et al., 2024. Economic feasibility studies for cultivation in swampland also offer insights into applicable methodologies Yesi et al., 2023.

Technical Efficiency of Cassava Production in the study Area

This objective aims to measure how effectively farmers utilize their available inputs (e.g., land, labor, capital) to produce cassava, relative to the optimal possible production given current technology. Stochastic Frontier Analysis is a parametric econometric approach that estimates a production frontier and an inefficiency component simultaneously. It requires data on inputs, outputs, and factors influencing inefficiency (e.g., farmer characteristics, access to extension services, market information). SFA is a robust tool for identifying inefficiencies in resource allocation. Data Envelopment Analysis is known as a non-parametric method, DEA constructs an efficiency frontier based on observed input-output data from a sample of farms. It identifies the most efficient farms and quantifies the inefficiency of others relative to this benchmark. Regression Analysis: While not a direct measure of efficiency, multiple regression models can identify factors that significantly influence cassava yield (output) given a set of inputs. This provides valuable insights into productivity drivers and potential areas for improving technical efficiency, as indirectly supported by studies discussing factors affecting profitability and management Bello et al., 2024.

Yield of Cassava

This objective is fundamental to understanding the productivity levels of cassava in wetland contexts and identifying the various factors that influence them. Recent advancements in crop

modeling and remote sensing offer powerful tools for yield estimation. Directly measuring cassava yields from representative sample plots within farmers' fields provides accurate, on-the-ground data. This remains a cornerstone for validating model predictions and farmer-reported data. Collecting yield data through surveys where farmers report their harvest quantities. While potentially subject to recall bias, it is a practical method for large-scale data collection. Models such as LINTUL5, embedded in frameworks like SIMPLACE, are used to estimate potential, water-limited, and nutrient-limited cassava yield gaps in Nigeria, considering climate factors Srivastava et al., 2023. These models are crucial for simulating yield under different environmental conditions and management practices, helping to understand limiting factors Grotelüschen et al., 2021. Recent studies also explore the response of cassava cultivars to nitrogen fertilizer, which directly impacts yield Andersen et al., 2024.

Coping Strategies of Farmers in Wetland Areas

This objective explores how farmers adapt and respond to environmental challenges and risks inherent in wetland cultivation, particularly in the face of climate change. Recent research from Nigeria highlights various adaptation strategies.

Including specific questions on the various coping strategies employed by farmers in response to challenges such as waterlogging, seasonal droughts, pest outbreaks, and market fluctuations. This includes strategies like adapting planting times, utilizing different cassava varieties (e.g., drought-tolerant or early-bulking varieties) Olaosebikan et al., 2023, implementing specific water management practices (e.g., swamp farming) Ologeh et al., 2020, diversifying crops or income sources, and community-level responses to environmental

stressors. Studies by Olutumise et al. Olutumise et al., 2024, Omodara et al. Omodara et al., 2023, and Ayinde et al. Ayinde et al., 2020 provide examples of investigating climate adaptation strategies and their predictors among cassava farmers in Nigeria. Furthermore, understanding farmer perceptions of climate change can reveal key barriers and enablers to adaptation Ologeh et al., 2020; Oluwatimilehin & Ayanlade, 2021.

2.6 Conceptual Framework

This project, through the application of this analytical framework, will significantly contribute to the existing body of knowledge regarding the intricate relationship between wetland ecosystems and cassava production. It will offer empirical data and analytical insights crucial for promoting sustainable agricultural development, informing climate change adaptation strategies, and guiding policy formulation for wetlands in Nigeria and other similar regions in Africa.

CHAPTER THREE

METHODOLOGY

3.1 AREA AND SCOPE OF STUDY

Edo State is referred to as the “heartbeat of Nigeria” and is located in the South-South geopolitical zone of Nigeria. Edo State is an oil-producing state, and is one of the nine Niger-Delta states in Nigeria. It has rich rainforest vegetation interspersed with hills as well as a rich cultural heritage that makes it a tourist destination. Edo State is also endowed with a wide variety of mineral resources, arable land for cash crops and largest oil palm yields in Nigeria. It is bordered by Kogi State to the North, Delta State to the East and South, and Ondo State to the West. Lying between latitude $5^{\circ} .44'$ and $7^{\circ} .34'$ North and longitude $5^{\circ} .4'$ and $6^{\circ} .45'$ East, the State has a land mass of 19,187 square km or (7,494.92 square miles). With

eighteen (18) local government areas, the State has an estimated population of 3,602,124 (Edo state gov.,2010).

Orhionmwon is a Local Government Area of Edo State, Nigeria. Its headquarter is in the town of Abudu. It is the largest local government area in Edo South Senatorial district. It was created during the days of the defunct Bendel State and Uhumwode local government was cut out in 1991. It has an area of 2,382 km and a population of 206,717 at the 2006 census (Census, 2006). The postal code of the area is 301. Orhionmwon local government area of Edo State is considered one of the biggest local government areas among those in Benin City. The main ethnic groups in Edo State are Bini, Afemais, Esans, Owans and Akoko Edos. Virtually all the groups traced their origin to Benin City hence the dialects of the groups vary with their distance from Benin City. The Bini speaking people who occupy seven out of the 18 Local Government Areas of the state constitute 57.54% while others Esan (17.14%) Afemai comprising Etsako (12.19%), Owan (7.43%), and Akoko Edo (5.70%) (Edo state gov., 2025). Orhionmwon towns and communities such as Abudu, Obazagbon-Nugu, Egbokor, Ugo, Urhonigben, Evbobanosa, Oza, Oben, Oloten, Okponha, Ugbeka, Igieduma, Ikhinwin, Igbanke, Ogan, Umoghunmwun etc.

3.2 Sampling procedure and sample size

A two-stage sampling procedure will be employed to select the respondents for the study. In the first stage, four wetland communities (Abudu, Igbanke, Ogan, Evbobanosa) and four arable land communities (Ugo, Ugbeka, Umoghunmwun, Obazagbon-nugu) will be purposively sampled from the major communities in Orhionmwon Local Government Area, based on their significant population of cassava farmers and incidence of preponderance of

wetland. The second stage involved is applying a simple random sampling technique to select 12 local cassava farmers from each of the four wetland communities and also corresponding 12 cassava local farmers from the arable land communities, resulting in a total of 96 local cassava farmers for the study.

3.3 Data collection

The data used in this study will be generated from a primary source. This will include administering questionnaires through interviews that will be scheduled. The questionnaire will be designed according to the specific objectives of the study.

3.4 Measurements of variables

Independent variables

The socioeconomic characteristics of the respondents will be measured by asking the respondents to indicate the following:

Age (will be measured in years)

Sex (will be measured where Male=1 and Female=0)

Marital status (will be measured as single or married)

Level of education (will be measured in years)

Years of cassava farming experience(will be measured in years)

Farm size (will be measured in hectares)

Source of labor (will be measured in man/day)

Cooperative membership (will be measured as yes or no)

Extension contact (will be measured as yes or no)

Use of Agrochemicals (will be measured in litres)

Fertilizer use(will be measured in kg)

Annual income (will be measured in Naira #)

Wetland soil status (will be measured where wetland=1 and arable land=0)

Dependent Variable:

The Yield of cassava (will be measured in Kg).

3.5 Data Analysis

OBJECTIVE 1

Describe the socio- economic characteristics of cassava farmers in the study area

This objective will be achieved using descriptive statistics such as mean, frequency distribution, percentage, standard deviation and variance. It will be used to describe the socio-economic characteristics of the cassava farmers

OBJECTIVE 2

Estimate and compare cost and returns and the profitability of farmers operating in the study area

Gross margin analysis will be used in determining the returns of the cassava production

$$G.M = TR - TVC \dots\dots\dots 1$$

Where:

TR= Total revenue

TVC= Total variable cost (#)

GM= Gross margin

$$TR = P \times Q \dots\dots\dots 2$$

Where:

P= Price

Q= Quantity

$$TVC = TC - TFC\dots\dots\dots 3$$

Where :

TC = Total cost

TFC= Total fixed cost

Gross margin involves the returns of an individual farmer enterprise, so that comparison can be made between the two cassava farmers enterprises. It is a very useful tool in the situation where fixed capital is a negligible portion of the farming enterprise.

OBJECTIVE 3

Estimate and compare technical efficiency between farmers in the study area

The Cobb Douglas stochastic frontier will be applied for estimation of the technical efficiency of the cassava production. The stochastic frontier function model is given as follows:

$$Y=f(X_i B_i) e \dots\dots\dots 4$$

$$e = V_i-U_i \dots\dots\dots 5$$

Where

Y = Output

β_i = parameters

e = error term

X_i = vector of input

In a more explicit form, the model can be given as

$$\ln Y_i = \beta_0 + \beta_1(\ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6) + V_i -$$

U_i 6

Where :

\ln = Natural logarithms

Y = Cassava Output (harvested) in tons

β_0 = Constant

β_1 - β_6 = Coefficient to be estimated

X_1 =Farm size (hectares)

X_2 = Farming experience in years

X_3 = Cropping system

X_4 = Family labour (man day)

X_5 = Hired labour (man day)

X_6 = Depreciation (#)

V = Random errors which are assumed to be independent of U, identical and normally distributed with zero and constant variance

U = Non negative random errors.

OBJECTIVE 4

Determine the yield of farmers in both wetland and arable land region

The output of the cassava production will be measured using :

$$\text{Yield} = \text{Quantity} \times \text{Kg/tuber}$$

In the comparison between the yield of wetland and arable land the T- statistics test is employed

Where X_1 = mean of wetland yield

X_2 = mean of dryland yield

S_1 = standard deviation of wetland yield

S_2 = standard deviation of dryland yield

N_1 = number of farmers in wetland area

N_2 = number of farmers in arable land area

OBJECTIVE 5

Identify the coping strategies farmers would employ in mitigating the effect of wetland

Likert scale

The response to the various constraints will be scored using a 5-level point likert scale. As a five point scale, the responses would be grouped into five;

Strongly agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly disagree = 1

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Socio-Economic Characteristics of Cassava Farmers

The Table 4.1 below gives a clear picture on the socio-economic characteristics:

4.1.1 Age Distribution of Respondents

The results in Table 4.1 shows that in wetland farmers between the age of 30 – 40 years were about 23.91%, those between 41 – 50 years were about 32.61%, those between 51 – 60 years were about 28.26%, those from 61 and above were about 15.22%. The table also shows that in arable land the farmers between the age of 30 -40 years were about 6.82%, those between 41 – 50 years were about 18.18%, those between 51-60 years were about 29.55%, those from 61 and above were about 45.45%. The age range mostly involved in the farming practice in wetland is farmers between 41 - 50 years and the ages that are less involved in farming practice is those from 61 and above,while in the arable land region The age range mostly

involving in the farming is from 61 and above and the age less involved in farming practice was between 30 - 40 years The mean of the ages of those in wetland is 50, and the mean of ages of those in arable land is 58

4.1.2 Marital Status of Respondents

The results in Table 4.1 shows the marital status in the wetland region are; Single (10.87%), Married (82.61%), Divorced (6.52%). For those in arable land; Single (0%), Married (93.18%), Divorced (6.82%) this also implies that the marital status is predominantly married which indicates there will be available help in terms of family labour and a lesser percentage of the respondents are divorced in both regions.

4.1.3 Gender Distribution of Respondents

The results in Table 4.1 shows the gender distribution in wetland, it implies that approximately 41% were female and approximately 59% were male. And the result obtained from arable land region is; Female is approximately (52%) and Male (48%) according to table 4.1 and this simply tells that in wetland there were more males involved in cassava production and in arable land there were more females involved in cassava production.

4.1.4 Education level of Respondents

The results in Table 4.1 shows the education status in wetland; No Education (13.4%), Primary (4.35%), JSS (6.52%), SSS (54.35%), OND/NCE (10.87%), HND/BSC (10.87%), MSC (0%) and in arable land we have; No Education (2.27%), Primary (9.09%), JSS (4.55%), SSS (43.18%), OND/NCE (25.00%), HND/BSC (11.36%), MSC (4.55%) this result means that the education level for most farmers both in wetland and arable land stops at secondary school level. The education level is a great indicator on how to make decisions and how to adopt new innovations which may bring about an increase in productivity.

4.1.5 Household size of the Respondents

The results in Table 4.1 shows that the number of people in a house in wetland can range from; 1-4 (43.48%), 5-8 (45.65%), 9 and above (10.82%) and on arable land can range from; 1-4 (9.09%), 5-8 (68.18%), 9 and above (22.73%). For most respondents in both regions the household size is within the range of 5-8 The average household size for the wetland region is 5, and the average for the arable land region is 7, implying that there is an appreciable source of family labour. According to the report of Bayacag (2001), there is a positive and significant relationship between household size and the farmer's efficiency in production. Since the production of cassava is not mechanized in the study area, farmers depend solely on human labour which is an important variable in agricultural production. The household size determines the available labour force to be employed in carrying out production activities.

4.1.6 Farming Experiences of the Respondents

The results in Table 4.1 shows the number of years the farmer has been practicing in wetland region 1-10 years (36.96%), 11-20 years (56.52%), 21 and above (6.52%) and in the arable land land it is 1-10 years (25.00%), 11-20 years (54.55%), 21 and above (20.45%). This indicates that the majority of farmers in wetland and arable land have a considerable amount of years which is within the range of 11 - 12 years that the production has been carried out. Experience could greatly influence the amount of output from cassava production due to the fact that the farmer would have encountered different challenges in the past that can be used to tackle any present challenge.

4.1.7 Farm Size of the Respondents

The results in Table 4.1 shows the average size of farm land used in the wetland region to be 1.4Ha and the average size of farm land used in arable land region is 1.7Ha. The size of your

farmland has a very great impact on the amount of output gotten from that farm; the larger the farm size the more the output received and the smaller the farm size the smaller the output received.

4.1.8 Member of Cooperative

The results in Table 4.1 shows the percentage of people that belongs to a cooperative and those that does not to any cooperative in wetland to be; Yes (26.09%), No (73.91%) and in arable land it is; Yes (56.82%), No (43.18%). The respondents that are members of a cooperative are at a higher advantage than those that do not belong to any cooperative because they tend to have first-hand information on innovations, when they are facing financial crisis they can lend money from the cooperatives and many other benefits.

4.1.9 Extension agent

The results in Table 4.1 shows the amount of time the farmers comes in contact with an extension agent; For Wetland: Weekly (0.00%), Monthly (4.35%), Quarterly (41.30%), Yearly (54.35%) and in arable land land: Weekly (0.00%), Monthly (13.95%), Quarterly (53.49%), Yearly (32.56%).

Table 4.1: Socioeconomic profile of respondents.

Characteristics

Wetland

Arable land

Freq

%

Mean

Freq

%

Mean

Age range (years)

30 – 40

11

23.91

3

6.82

41 – 50

15

32.61

8

18.18

51 – 60

13

28.26

13

29.55

61+

7

15.22

50

20

45.45

58

Total

46

100.00

44

100.00

Marital Status

Single

5

10.87

0

.00

Married

38

82.61

41

93.18

Divorced

3

6.52

3

6.82

Total

46

100.00

44

100.00

Gender

Female

19

41.30

23

52.27

Male

27

58.70

21

47.73

Total

46

100.00

44

100.00

Education

None

6

13.04

1

2.27

FSLC

2

4.35

4

9.09

JSS

3

6.52

2

4.55

SSS

25

54.35

19

43.18

OND/NCE

5

10.87

11

25.00

HND/BSc

5

10.87

5

11.36

MSc/PhD

0

.00

2

4.55

Total

46

100.00

44

100.00

Household Size (range)

1 - 4

20

43.48

4

9.09

5 - 8

21

45.65

30

68.18

9+

5

10.87

10

22.73

Total

46

100.00

5

44

100.00

7

Farming Experience range (years)

1 - 10

17

36.96

11

25.00

11 - 20

26

56.52

24

54.55

21+

3

6.52

9

20.45

Total

46

100.00

14

44

100.00

17

Farm size (ha)

1.4

1.7

Member Of Cooperative

No

34

73.91

19

43.18

Yes

12

26.09

25

56.82

Total

46

100.00

44

100.00

Extension Agent contact

Weekly

0

.00

0

.00

Monthly

2

4.35

6

13.95

Quarterly

19

41.30

23

53.49

Yearly

25

54.35

14

32.56

Total

46

100.00

43

100.00

SOURCE, FIELD SURVEY 2025

4.2 RESULT OF PROFITABILITY ANALYSIS

The cost and returns provide insights into the profitability of cassava in the study area. The results in Table 4.2 presents the cost, revenue and gross margin of farmers in wetland and Arable land derived from the study. The result showed that the mean cost of stem cutting acquired in wetland was ₦207,608.70 with the standard deviation of ₦77,033.40 while that of the arable land land was ₦408,579.55 with standard deviation of ₦95,305.70. The mean cost of fertilizer in wetland region was ₦106,793.48 with standard deviation of ₦69,871.70

while in the arable land land region the mean cost was ₦118,238.64 with the standard deviation of ₦82,672.00. The mean cost of labour in wetland region was ₦98,130.43 with the standard deviation of ₦104,075.30 while the mean cost in the arable land land region was ₦93,704.55 with the standard deviation of ₦76,766.80. The mean cost of agrochemicals used in the wetland region was ₦35,478.26 with the standard deviation of ₦25,306.80 while in arable land land the mean cost was ₦52,931.82 and the standard deviation was ₦37,011.20. The mean of total variable cost in the wetland region was ₦472,141.30 with the standard deviation of ₦282,523.80 while in the arable land land the mean total variable cost was ₦698,909.11 with the standard deviation of ₦296,244.30. Furthermore, the mean of the total revenue in the wetland region was ₦651,746.67 with the standard deviation of ₦522,870.30 and in the arable land land region the mean total revenue was ₦1,225,998.87 with the standard deviation of ₦1,105,170.80. The Gross margin analysis in the wetland region had a mean of ₦179,605.37 and the arable land had a mean of ₦527,089.76. The profitability analysis from this study shows that it is more profitable for a farmer who carries out production activities in the arable land region than the farmers in the wetland region.

Table 4.2: Cost and Return Structure (average per farmer)

Items

Wetland

Arable land

Mean

SD

Mean

SD

Stem Cutting

207,608.70

77,033.40

408,579.55

95,305.70

Fertilizer

106,793.48

69,871.70

118,238.64

82,672.00

Labour

98,130.43

104,075.30

93,704.55

76,766.80

Agrochemical

35,478.26

25,306.80

52,931.82

37,011.20

Land

24,130.43

6,236.60

25,454.55

4,488.60

TVC

472,141.30

282,523.80

698,909.11

296,244.30

Depreciation

29,021.74

11,333.70

36,651.16

12,183.90

TC

501,163.04

293,857.50

735,560.27

308,428.20

REVENUE

Output

105.01

75.8

184.55

130

Price/Bag

6,206.52

1,561.00

6,643.18

1,597.90

TR

651,746.67

522,870.30

1,225,998.87

1,105,170.80

GM

179,605.37

527,089.76

Profit

150,583.63

105,553.60

490,438.60

221,560.00

SOURCE, COMPUTED FROM FIELD SURVEY 2025.

4.3a Technical Efficiency

The result in table 4.3a shows the maximum likelihood estimates (MLE) of the stochastic frontier model provides insight on the key factors influencing cassava production efficiency;

Man/Day per season (4.467, $p < 0.05$) was positive and highly significant implying that there's a direct relationship between labourers and yield meaning the number of labourers has a great impact on the output level. As the number of men increases the output of cassava increases. Farm size (23.907, $p < 0.01$) has a very strong positive effect, the larger farm size greatly increases cassava output that means as the farmland increases the yield of the cassava also increases.

4.3b Technical Efficiency Range

The results in Table 4.3b indicates that the mean technical efficiency for cassava farmers in the study area are 0.629 and 0.632 for wetland and arable land respectively; suggesting that on average farmers in wetland operates at 62.9% efficiency and the farmers in arable land operates at 63.2% efficiency relative to the best performing farms. In the wetland region, the majority of the farmers (52.17%) falls under the 0.751 – 1.000 TE range, indicating a relatively high level of efficiency among this group, another group of farmers (32.61%) falls below 0.501 TE range, signifying inefficiencies likely due to suboptimal input use, inadequate technical knowledge or other production constraints. Likewise the arable land region, majority of farmers (54.55%) belongs to the category 0.751 – 1.000 TE range, implying that the farmers produce at optimum level, some other farmers (34.09%) falls below 0.501 TE range, which means there are some inefficiencies due to inadequate technical knowledge, suboptimal input use or other production constraints.

4.3A Technical Efficiency Estimates

final MLE estimates:

coefficient

standard-error

t-ratio

beta 0

Constant

-27.362

0.995

-27.492

beta 1

Stem Cutting

0.618

0.621

0.995

beta 2

Fertilizer

0.518

0.345

1.498

beta 3

Man/Days Per Season

4.467

0.934

4.783

beta 4

Agrochemical

0.410

0.350

1.172

beta 5

Land

0.221

0.374

0.590

beta 6

Farm Size

23.907

0.996

24.009

beta 7

Depreciation

-0.184

0.424

-0.433

Inefficiency Model

delta 0

Constant

0.079

0.751

0.105

delta 1

Age

0.113

0.078

1.462

delta 2

Gender

-0.148

0.856

-0.172

delta 3

Education

-1.033

3.055

-0.338

delta 4

Household Size

0.108

0.606

0.179

delta 5

Farming Experience

-0.223

0.266

-0.837

sigma-squared

98.435

0.997

98.770

Gamma

0.001

0.011

0.098

log likelihood function = -330.90

LR test of the one-sided error = 3.74; with number of restrictions = 7

[note that this statistic has a mixed chi-square distribution

SOURCE, COMPUTED FROM FIELD SURVEY 2025.

Table 4.3B: Technical efficiency estimates distribution

Efficiency Range

Wetland

Arable land

Freq

%

Mean

Freq

%

Mean

<= 0.250

9

19.57

11

25.00

0.251 - 0.500

6

13.04

4

9.09

0.501 - 0.750

7

15.22

5

11.36

0.751 - 1.000

24

52.17

24

54.55

Total

46

100.00

0.629

44

100.00

0.632

SOURCE, COMPUTED FROM FIELD SURVEY 2025.

4.4 Yield of farmer in Wetland and Arable land

According to the results in Table 4.4 the average quantity of output gotten per farm in the wetland region is 70,67 and the kg for each bag is 20kg, therefore the average yield gotten per farm in the wetland region is 1,413.4kg. Just like the wetland the arable land has a mean quantity of output per farm to be 113.95, therefore the average yield obtained in the arable land region is 2,279kg.

HYPOTHESIS TESTING

H₀: There is no significant difference in the output of cassava production between wetland and arable land region of the study area.

H0: There is no significant difference in the yield per farm size between wetland and arable land region in the study area.

H0: There is no significant difference in the profits between wetland and arable land region in the study area.

Interpretations

Cassava output from dryland areas is significantly greater than that from wetlands. This indicates that, contrary to expectation, cassava performs better on the relatively drier soils of the study area.

The average profit for dryland farmers (₦ 490,438.60) was far greater than that for wetland farmers (₦ 150,583.63). The mean difference (₦ -339,854.97) with a t-value of 3.13 is significant. Cassava farming in the dryland region is more profitable than in the wetland region. Higher profits in dryland areas arise from both greater output and possibly lower production costs (since wetland operations often require extra labour for drainage and land preparation). Thus, while wetlands provide moisture advantage, poor water control can increase cost and reduce net returns.

Dryland farmers achieved a mean yield of 113.95 bags per farm, while wetland farmers had 70.67 bags. The mean difference (-43.28) and a high t-value (6.59) show a very significant difference. Yield per unit of farm size is markedly higher on dryland farms. This reinforces the conclusion that cassava performs better in moderately drained soils compared with wetter environments. The result implies that soil aeration and management conditions in the dryland favor efficient utilization of land resources for cassava production.

4.4: T-Test

Parameters

Wetland

Arable land

Mean

difference

t

value

N

Mean

SD

N

Mean

SD

Output

46

105.01

75.82

44

184.55

129.95

-79.54

3.56

TR

46

651,746.67

522,870.31

44

1,225,998.87

1,105,170.78

-574,252.20

3.41

Profit

46

150,583.63

105,553.60

44

490,438.60

221,560.01

-339,854.97

3.13

Yield (bag) per farm size

46

70.67

18.08

44

113.95

40.50

-43.28

6.59

Technical Inefficiency estimates

46

0.63

0.34

44

0.63

0.36

0.00

0.04

SOURCE COMPUTED FROM FIELD SURVEY 2025

4.5 Coping strategies

The results in Table 4.5 presents the various coping strategies adopted by cassava farmers in both wetland and arable land in the study area. The results reveal that farmers employ different adaptive measures to mitigate the effects of environmental and economic challenges associated with cassava production.

The results show that a higher proportion of wetland farmers (47.8%) engaged in off-farm activities compared to 25% of dryland farmers. This implies that wetland farmers tend to diversify their income sources by engaging in other forms of employment or trading activities

to supplement farm income due to the fact that the cassava production in this area has peak season and does not happen all year round. Similarly, 36.9% of wetland farmers received diaspora remittances, while only 20.4% of dryland farmers benefited from such support. This suggests that wetland farmers have relatively stronger external social networks and family support compared to their dryland counterparts. Access to pension among farmers was generally low in both environments. Only 10.8% of wetland and 18.1% of dryland farmers had access to pension funds, indicating that most of the respondents operate in the informal agricultural sector without formal retirement benefits. Furthermore, none of the farmers in either group reported benefiting from any social safety network, while 93.1% and 100% of dryland and wetland farmers, respectively, indicated no access to government grants. This underscores the absence of institutional support systems for rural farmers in the study area. Membership of cooperative societies was more prevalent among dryland farmers (34%) compared to 15.2% of wetland farmers. This indicates that dryland farmers rely more on collective organizations to access resources and share information that can help them cope with production risks. In terms of animal husbandry, 32.6% of wetland farmers practiced it compared to only 6.8% of dryland farmers, suggesting that wetlands offer better access to feed and water resources suitable for livestock production. Integrated farming, which involves combining crop and livestock production, was practiced exclusively by wetland farmers (30.4%), while none of the dryland farmers adopted this system. This may be due to the ecological suitability of wetland areas, which provide better opportunities for resource recycling and diversification. Finally, none of the farmers in either wetland or dryland areas reported access to subsidized farm inputs, indicating a total lack of government intervention in reducing production costs.

Overall, the results show that wetland farmers adopt a wider range of coping strategies than dryland farmers. While dryland farmers rely more on cooperative membership and limited pension access, wetland farmers diversify through off-farm employment, remittances, animal husbandry, and integrated farming. However, both groups face serious institutional constraints such as lack of access to social safety nets, government grants, and subsidized farm inputs.

Table 4.5: Coping Strategies

Strategies

Wetland

Arable land

Yes

No

Yes

No

Freq

%

Freq

%

Freq

%

Freq

%

Off Farm Activities

22

47.83

24

52.17

11

25

33

75

Diaspora Remittance

17

36.96

29

63.04

9

20.45

35

79.55

Access To Pension

5

10.87

41

89.13

8

18.18

36

81.82

Social Safety Network

0

0

46

100

0

0

44

100

Government Grant

0

0

46

100

3

6.82

41

93.18

Member Of Cooperative

7

15.22

39

84.78

15

34.09

29

65.91

Animal Husbandry

15

32.61

31

67.39

3

6.82

41

93.18

Integrated Farming

14

30.43

32

69.57

0

0

44

100

Subsidized Farm Input

0

0

46

100

0

0

44

100

SOURCE, COMPUTED FROM FIELD SURVEY 2025.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

This study examined the effect of wetland on cassava production in Orhionwon Local Government Area of Edo State, Nigeria. The results provide answers to these questions: describe the socioeconomic characteristics of cassava farmers in wetland and arable land areas, estimate and compare the cost and returns as well as profitability of cassava production between wetland and arable land farmers, estimate and compare the technical efficiency of cassava farmers in both areas, estimate and compare the yield of farmers in both areas and identify the coping strategies employed by cassava farmers in mitigating the effects of wetland and arable land conditions.

Primary data were analyzed using descriptive statistics, profitability analysis, stochastic frontier model, and t-test.

The results revealed that the majority of cassava farmers in both wetland and arable land areas were married and within the age range of 41–60 years, implying that cassava production is largely undertaken by middle-aged farmers. Males dominated cassava production in wetland areas (58.7%), while females were slightly more involved in arable land areas (52.3%). Most farmers in both areas had formal education, though educational

attainment was higher among arable landfarmers, with a greater proportion possessing OND/NCE certificates.

The average farm size was 1.4 hectares for wetland farmers and 1.7 hectares for arable landfarmers. The majority of farmers in both areas had over 10 years of farming experience. Membership in cooperatives was more common among arable landfarmers (56.8%) than among wetland farmers (26.1%), and extension contact was mostly quarterly and yearly.

The profitability analysis revealed that cassava production is profitable in both areas, but arable landfarmers earned higher profits per hectare. On average, the gross margin and profit per hectare were ₦310,052.80 and ₦288,493.29 respectively for arable landfarmers, compared to ₦128,289.55 and ₦107,559.73 for wetland farmers. The t-test showed that differences in output, total revenue, and profit were statistically significant ($p < 0.05$), implying that cassava farmers in arable landareas had a clear profitability advantage over their wetland counterparts.

The stochastic frontier analysis showed that labour and farm size had significant positive effects on output, while depreciation had a negative but insignificant effect. The mean technical efficiency scores were 0.629 for wetland farmers and 0.632 for arable landfarmers, indicating that both groups were operating at similar levels of efficiency. The t-test further confirmed that there was no significant difference in technical efficiency between the two groups.

The major constraints faced by cassava farmers in both areas included high cost of labour and agrochemicals, unpredictable input prices, poor access to credit facilities, pest and disease infestation, and climate-related problems such as drought and flooding.

Common coping strategies adopted by farmers included engaging in off-farm activities, receiving remittances, integrated farming, animal husbandry, and participation in cooperatives. Only a few farmers benefitted from government grants or subsidized inputs.

5.2 Conclusion

Based on the findings, the study concludes that:

1. Cassava production is profitable in both wetland and arable land environments, but profitability is significantly higher in the arable land areas due to better yield and relatively lower production risks.
2. The technical efficiency of cassava farmers in both wetland and arable land areas is similar, suggesting that farmers in both areas are effectively utilizing their available resources.
3. Environmental factors such as flooding in wetlands and drought in drylands have major impacts on production outcomes.

4. Socioeconomic factors such as education, cooperative membership, and access to credit facilities play crucial roles in enhancing cassava productivity and profitability.

5. Cassava farmers in both areas face multiple production constraints, particularly high labour costs, high agrochemical prices, and poor access to funds, which limit their productivity potential.

5.3 Recommendations

In view of the findings and conclusion, the following recommendations are made:

1. Improved Access to Credit:

Government agencies, microfinance institutions, and agricultural banks should provide cassava farmers with accessible and affordable credit facilities to enable timely purchase of inputs and adoption of improved production technologies.

2. Encouragement of Cooperative Participation:

Farmers, especially in wetland areas, should be encouraged to join or form cooperatives to enhance access to credit, inputs, extension services, and marketing opportunities.

3. Provision of Subsidized Inputs:

The government should provide subsidized stem cuttings, fertilizers, and agrochemicals to help reduce the high cost of production, particularly for wetland farmers.

4. Development of Drainage and Irrigation Facilities:

Investments in proper drainage systems in wetlands and irrigation facilities in drylands will help mitigate the effects of flooding and drought, thereby enhancing cassava yield and sustainability.

REFERENCES

- Adiele, J. G..(2020). *Growing out of hunger: towards an improved understanding of the water and nutrient limited yield of cassava..* Wageningen University & Research.
- Akinwumiju, A. S., Adelodun, A. A., & Orimoogunje, O. O. I.(2020). *Agro-climato-edaphic zonation of Nigeria for a cassava cultivar using GIS-based analysis of data from 1961 to 2017.* Scientific Reports, 10, 1259.
- Aghanenu, A. S., & Onemolease, E. A. (2012). *Farmers' response to the application of modern technologies to wetland in Edo State, Nigeria.* Journal of agriculture and food information, 13(3), 267 - 282, <https://doi.org/10.1080/10496505.2012.694408>

Akpabio, E. M., & Umoh, G. S.(2021). *The practical challenges of achieving sustainable wetland agriculture in Nigeria's Cross River basin*. *Wetland International*,46(1),
<https://doi.org/10.1080/0250806.2020.1863698>

Akparobi, S., Eruotor, P., & Agbogidi, M. (2007). *Evaluation of twelve cassava genotypes in derived Guinea Savanna agroecological zones of Nigeria*. *Journal of Agriculture, Science and Technology*, 8(1), 92–102. <https://doi.org/10.4314/jagst.v8i1.31729>

Adeniji, T., Hart, A., Tenkouano, A., Barimalaa, I., & Sanni, L. (2010). *Comparative study of pasting properties of improved plantain, banana and cassava varieties with emphasis on industrial application*. *African Journal of Food, Agriculture, Nutrition and Development*, 10(5). <https://doi.org/10.4314/ajfand.v10i5.56342>

Andersen,T.R,(2013). *Denitrification in riparian zones and other saturated soils of a northeastern agricultural landscape*. *Cornell University ProQuest Dissertations & Theses*, 2013. 3576399.

Asante-Pok,A (2013). *Analysis of incentives and disincentives for cassava in Nigeria*. *Gates open research*

Ayinde, A. F. O., Fadilat, O., Johnston, P., Olarenwaju O. Purnamita D.(2020).*Cassava-Based Farmers' Sociodemographic Characteristics and Perception Predict Adaptation Strategies to Climate Variability in Rain Forest and Derived Savannah Ecosystems of Nigeria?* *African Journal of Sustainable Development*, 10, 11-20.

Babatunde, A. A., Yusuf, S. & Omonona, B. T.(2022). *Profitability Analysis among Actors of High-Quality Cassava Flour in South West Nigeria*. Journal of Economics and Sustainable Development, 13, 40-52.

Bello, T., Oguntade, A., & Afolayan, T. T.(2025). *Profitability and Efficiency of Cassava Production in Ekiti State, Nigeria*. The International Journal of Agriculture & Biology, 12, 1-10.

Bossa, A. Y., Diekkrüger, B., Giertz, S.G. Steup , L.O. Sintondji , E.K. Agbossou , & C. Hiepe . (2012). *Modeling the effects of crop patterns and management scenarios on N and P loads to surface water and groundwater in a semi-humid catchment*. Environmental Earth Sciences, 67, 2095-2108.

Cools, J., Johnston, R., Hattermann, F. F.Hattermann, W. Douven,& I. Zsuffa.(2013). *Tools for wetland management: Lessons learnt from a comparative assessment*. Environmental Science & Policy, 34, 14-26.

Daniels, J. A.Rajagopalan K. & Syed S.H. Rizvi, (1985). *A Review of Effects of Carbon Dioxide on Microbial Growth and Food Quality*. Journal of food protection, 48(6), 532 - 537

Delaquis, E., de Haan, S., & Wyckhuys, K. A. G. (2018). *On-farm diversity offsets environmental pressures in tropical agro-ecosystems: A synthetic review for cassava-based systems*. Agriculture, Ecosystems & Environment, 237, 182-192.

Ehinmowo, O. O., Afolabi, J. A., & Fatuase, A. I. (2015). *Determinants of Profitability Among Small Scale Cassava Processors in South Western Nigeria*. International Journal of Agricultural Research and Review, 3, 137-142.

Eke-Okoro, N. O., & Njuko, J. A.. (2009). *Biotic stress and productivity of improved cassava varieties for food security*. Journal of Agricultural biotechnology and sustainable development, 1(2), 039 - 043

Ogunbode, T. O., Jazat, J. P., & Akande, J. A.(2023). *Potency of some economic variables affecting environmental quality in Nigeria*. Scientific Reports, 13, 1-10.]

Ezui, K. S.(2017). *Understanding the productivity of cassava in West Africa..* Wageningen University & Research.

FAOSTAT.. FAOSTAT statistical database. *Food and Agriculture Organization of the United National* <https://www.fao.org/faostat/en/#data>

Grotelüschen, K., Gaydon, D. S., Langensiepen, M.,S. Ziegler, J. Kwesiga, K.

Senthilkumar, A. M. Whitbread, & M.Becker (2021). *Assessing the effects of management and hydro-edaphic conditions on rice in contrasting East African wetlands using experimental and modelling approaches*. Agricultural Water Management, 258, 107222.

Hirooka, Y., Awala, S. K., Hove, K.,P. I. Nanhapo, M.lijima .(2021). *Effects of Cultivation Management on Pearl Millet Yield and Growth Differed with Rainfall Conditions in a Seasonal Wetland of Sub-Saharan Africa*. Agronomy, 11, 2118.

Johnston, R., Cools, J., Liersch, S., S. Morardet, C. Murgue, M. Mahieu, I. Zsuffa, GP.Uyttendaele.(2013). *WETwin: A structured approach to evaluating wetland management options in data-poor contexts*. *Environmental Science & Policy*, 34, 1-13.

Kotir, J. H., Brown, G., Marshall, N.& R. Jawstone(2017). *Systemic feedback modelling for sustainable water resources management and agricultural development: An application of participatory modelling approach in the Volta River Basin*. *Journal of Environmental Management*, 181, 178-189.

Liu, K., Harrison, M. T., Shabala, S., & Wu, Q.(2020). *The state of the art in modeling waterlogging impacts on plants: What do we know and what do we need to know*. *Earth's Future*, 8, e2020EF001801.

National Research Council. 1995. *Wetlands: Characteristics and Boundaries*. Washington, DC:National Academies Press.

Obasi, C.C.(2018). *Effects of Paramagnetic Minerals on Pore- Size Distribution in Shale*.Oklahoma State University ProQuest Dissertations & Theses, 2018. 13419650.

Olaosebikan, O., Bello, A., Utoblo, O.,N.Olutegebe, E. Garner, B.Teeken, E.Bryan, L.Forsythe, S.Cole, P.Kulakow, C. Egesi, H. Tufan,& T. Madu, (2023). *Stressors and Resilience within the Cassava Value Chain in Nigeria: Preferred Cassava Variety Traits and Response Strategies of Men and Women to Inform Breeding*. *Sustainability*, 15, 8089.

Olarewaju, T. O., Shittu, A. M., & Dipeolu, A. O., (2022). *Wetland importance and dependence among households around the Ogun River Basin, Nigeria*. Journal of Agriculture and Environment for International Development, 116, 163-176.

Ologeh, I., Adesina, F., & Sobanke, V.(2020). *Assessment of Farmers' Indigenous Technology Adoptions for Climate Change Adaptation in Nigeria*. GeoJournal, 85, 1803-1818.

Olutumise, A. I., Ekundayo, B. P., & Omonijo, A. G.(2024). *Unlocking sustainable agriculture: climate adaptation, opportunity costs, and net revenue for Nigeria cassava farmers*. Journal of Agriculture and Food Research, 15, 100806.

Oluwatimilehin, I. A., & Ayanlade, A. A(2021).. *Agricultural community-based impact assessment and farmers' perception of climate change in selected Ecological Zones in Nigeria*. GeoJournal, 86, 2565-2579.

Omodara, O. D., Ige, O. A., Oluwasola, O., (2023). *Factors influencing cassava farmers' choice of climate change adaptation practices and its effect on cassava productivity in Nigeria*. Journal of Cleaner Production, 420, 138330.

Oshunsanya, S. O., & Nwosu, N. J.(2018). *Soil-Water-Crop Relationship: A Case Study of Cassava in the Tropics*. In J. R. M. De Miranda, *Cassava, Production and Processing*. IntechOpen.

Oyekola, I. A.(2021). *Social, Economic and Ecological Factors Influencing Cassava Farming in Nigerian Rural Context*. International Journal of Research and Innovation in Social Science, 5, 304-312.

Oyotomhe, E., (2025). *Evaluation of improved cassava genotypes for fresh root yield and yield components in demand creation trial*. *Agronomy Journal*, 117, 762-774.

Paul , A., Tikwe , K., & Nakwe , S. (2021). *Cassava and Vegetable Farming on Wet Land among Farmers in Ibaji Local Government Area, Kogi State, Nigeria*. *Journal of Agricultural Extension*, 25(1), 48–61. <https://doi.org/10.4314/jae.v25i1.4S>

Punyasu, N., Thaiprasit, J., Kalapanulak, S., & Saengwilai, P.(2025). *Modeling cassava root system architecture and the underlying dynamics in shoot–root carbon allocation during the early storage root bulking stage*. *Frontiers in Plant Science*, 15, 1374526.

Rasmussen, K., Bruun, T. B., & Birch-Thomsen, T.(2012). *Analysis of the potential for sustainable, cassava-based bioethanol production in Mali: Feasibility of renewable energy resources in Mali*. *Energy for Sustainable Development*, 16, 220-227.

Rozi, F., Darsani, Y. R., & Elisabeth, D. A.(2024). *The development opportunity of cassava farming under perennial crops to support food security in forest communities*. *E3S Web of Conferences*, 444, 02024.

Sanusi, O.S.& Olurotomi J.A.,(2020).*Structural and hydrothermal alteration mapping related to orogenic gold mineralization in part of Kushaka schist belt, North-central Nigeria, using airborne magnetic and gamma-ray spectrometry data*. Volume 2, article number 1591, (2020)

Srivastava, A. K., Ewert, F., Akinwumiju, A. S.,(2023).. *Cassava yield gap—A model-based assessment in Nigeria*. *Agricultural Systems*, 204, 103565.

Yesi, D., Karenina, T., Defriyanti, W. T., (2023). *Economic Feasibility of Floating Cultivation System on Swampland*. Jurnal Inovasi Pertanian, 6, 1-9.